

# Webinar – Ductwork airtightness: Standardisation's on- going work and an overview of status and trends in Sweden, Japan, Spain and Portugal

25 January 2018



EBC  
Energy in Buildings and  
Communities Programme



Air Infiltration and Ventilation Centre

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# Tight Vent Europe

BUILDING AND DUCTWORK AIRTIGHTNESS PLATFORM

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## ★ Hot news

Register now for the **TightVent webinar on Ductwork Airtightness**. Thursday 25 January 2018, 09:00-10:30 (CET)...[more](#)

Register now for the **AIVC International workshop on ventilation and airtightness**. 19-20 March 2018, Wellington, New Zealand...[more](#)

**AIVC Workshop on Ventilation for Indoor Air Quality and Cooling**. Friday 23 March 2018, Sydney, Australia...[more](#)

**39<sup>th</sup> AIVC – 7<sup>th</sup> TightVent – 5<sup>th</sup> venticool joint Conference in Juan-les-Pins, France**. The 7<sup>th</sup> TightVent conference will be held on 18 and 19 September 2018 in Juan-les-Pins, France together with the 39<sup>th</sup> AIVC conference...[more](#)

**Energy Efficiency and Indoor Climate in Buildings is out**. This monthly online newspaper contains relevant information on TightVent Europe, AIVC, venticool & IEA EBC annex 62 and EU relevant information (from the [BUILD UP platform](#)). [Subscribe](#) to get informed on a regular basis on the platforms' activities... [more](#)

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## Recent News

- TightVent welcomes SIGA as new partner
- 23 March 2018, Workshop, Sydney (AU) – Ventilation for Indoor Air Quality and Cooling
- 25 January 2018, Webinar – “Ductwork airtightness: Standardisation’s on-going work and an overview of status and trends in Sweden, Japan, Spain and Portugal”
- TightVent newsletter issue #13 – November 2017 now available
- Feedback from the 38<sup>th</sup> AIVC & 6<sup>th</sup> TightVent conference: Summary of the airtightness track

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# AIVC 2018

39<sup>th</sup> AIVC - 7<sup>th</sup> TightVent & 5<sup>th</sup> venticool Conference

Smart ventilation for buildings

18-19 September 2018, Antibes Juan-Les-Pins Conference Centre,  
Antibes Juan-Les-Pins, France

236 8 47 6  
DAYS HOURS MINUTES SECONDS

## AIVC Workshop: 19-20 March, 2018

HOME / EVENT



AIVC Workshop: 19-20 March 2018 - Te Papa, Wellington. BRANZ, AIVC and ASHRAE are organising a joint international workshop under the umbrella of the Air Infiltration and Ventilation Centre (AIVC). The objective of this workshop is to discuss and identify ways to improve the quality of our homes with respect to

**START**  
March 19, 2018 - 12:00 am  
**END**  
March 20, 2018 - 12:00 am

**CATEGORIES**  
SIG

### AIVC Workshop: 19-20 March 2018 - Te Papa, Wellington

BRANZ, AIVC and ASHRAE are organising a joint international workshop under the umbrella of the Air Infiltration and Ventilation Centre (AIVC). The objective of this workshop is to discuss and identify ways to improve the quality of our homes with respect to airtightness and ventilation, as well as discussing the impact suboptimal performance has on energy consumption and health of the occupants. Also of interest are the impacts of mandatory airtightness targets and how best to implement these, if at all. We are expecting speakers from New Zealand, USA, China, Australia, and Europe.

The workshop will be held at the Museum of New Zealand Te Papa Tongarewa on Monday and Tuesday the 19 & 20 March (9.00am start, 8:00 registration).

The registration page and further up-to-date information about the workshop can be found at: [click here](#).

We anticipate the workshop will bring together representatives from industry, research organisations, government departments, as well as other key stakeholders, to share a broad spectrum of views and experiences.

We hope that you are able to attend and contribute to the discussions.

We recommend to register early as space is limited.

**TAGS:** INDOOR AIR SIG EVENTS




**Forward**

Welcome to the November 2017 issue of the TightVent Europe newsletter. In the current edition, Professor Arnold Janssens presents the highlights of the airtightness track at the 39th AIVC 'TightVent & 5th Ventilation' joint conference held in Brussels, Belgium, on 18-19 September 2017. Further on, Dr. Dušan Čoukaj gives an overview of the newly launched European certification programme for Ventilation Units.

As in previous editions, this issue provides detailed information on upcoming events in the field of ventilation & airtightness. A major TightVent event is the upcoming 39th AIVC 'TightVent & 5th Ventilation' joint conference held in Brussels on 18-19 September 2017. A specific track largely devoted to ventilation & airtightness will take place on March 19-20, 2018 in Wellington, NZ.

Please visit our website, follow us on Twitter and LinkedIn and subscribe to our monthly newsletter 'Energy Efficiency and Indoor Climate in Buildings' to find out more about our activities.

We wish you a pleasant reading and look forward to seeing you in our future events (check our Events Calendar on page 4).

The TightVent team

**18-19 September 2018 - 39th AIVC & 7th TightVent conference in Juan-les-Pins, France**

- Field data and case studies
- Infiltration measurement techniques and 3D modelling
- Compliance schemes and barriers to innovation
- Ventilation in renovated buildings
- Case study for airtight submission
- Verification of airtightness
- Verification of airtightness acceptance
- March 1, 2018
- Deadline for 18 paper submission: June 10, 2018
- The conference is organised by:
  - CEETA, the French technical centre for the heating, ventilation and air conditioning industries
  - AECME, the French environment and energy management agency
  - INIVE, the International Network on Ventilation and Energy Performance on behalf of the Air Infiltration and Ventilation Centre (AIVC), TightVent Europe and ventool the international platform for ventilative cooling

For more information please visit: <http://www.aivc.org/conferences>

**In this issue**

- Forecast
- 18-19 September 2018 - 39th AIVC & 7th TightVent conference in Juan-les-Pins, France
- Feedback from the 39th AIVC & 7th TightVent conference: Summary of the airtightness track
- AIVC Workshop on ventilation & airtightness, 19-20 March 2018, Wellington, NZ
- European certification programme for ventilation units
- Field of energy efficiency in buildings and outdoor air pollution
- Energy Calendar
- Profile news from our partners



**Forward**

Welcome to the September 2017 edition of the AIVC newsletter. In this issue you will find facts and information on newly released AIVC publications and major upcoming AIVC events. Moreover, this issue features conceptual and ongoing AIVC projects from 2017 to 2027 and extracts from more detailed information available on our website.

Let us not leave Dr. Andy Pardy presenting significant advances in the fields of IAQ and ventilation, with a new approach for estimating CO2 generation rates from building occupants.

Please visit our website, follow us on Twitter and LinkedIn and subscribe to our monthly newsletter 'Energy Efficiency and Indoor Climate in Buildings' to find out more about our activities. Also, don't forget to mark your agenda for the following upcoming major events:

- International workshop "ventilative cooling in buildings: now & the future" on 23 October 2017, in Brussels, Belgium
- AIVC international workshop "Towards higher performing homes: the fields of IAQ and ventilation and Airtightness" on March 19-20, 2018, in Wellington, New Zealand
- 39th AIVC Conference on September 18-19, 2018 in Juan-les-Pins, France

We wish you a pleasant reading and look forward to seeing you in our future events.

Peter Winkler, Operating Agent AIVC

**IAQ metrics workshop recordings & presentations available**

The AIVC workshop "to ventilation the present to indoor air quality in buildings? Do we need performance based approaches?" was held in Brussels, Belgium on 14-15 March 2017. The event aimed to identify the pros and cons of performance based approaches and metrics that can be considered to assess the indoor air quality (IAQ) performance of ventilation systems, as well as to draft guidelines for their use in standards and regulations.

The presentations of the workshop are now available at the AIVC website.

Recordings of the presentations that follow are also available on YouTube:

- Indoor carbon dioxide as metric of ventilation and IAQ: You or the AIAQ? Andrea Perini, NEST, Denmark
- A hybrid 1/5 generated air quality index: feel you about indoor air quality? Peter Winkler, STPA, Denmark
- Considerations on IAQ metrics from regulatory and compliance point of view - case of IAQ metrics in practice, Peter Winkler, NEST, Belgium

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**Forward**

We are happy to introduce to you the 11th newsletter of the venticool platform of December 2017.

Our first two articles, provide feedback on the ventilative cooling workshop in Brussels followed by the final IEA EBC Annex 62 expert meeting in Gent in October, 2017. Further on, Professor Maria Kolokotroni presents the summarizing of the ventilative cooling track at the 39th AIVC 'TightVent & 5th Ventilation' joint conference held in Rotterdam, UK on 18-19 September, 2017. Christopher Plesner from Voka, follows up on his last article on new work items recently approved by CER and ISO with regard to ventilative cooling.

As usual, this edition provides detailed information on upcoming events in the field of ventilative cooling. A major venticool event is the upcoming 39th AIVC 'TightVent & 5th Ventilation' joint conference: "Smart ventilation for buildings" in Juan-les-Pins, France on 18-19 September 2018, with a specific track largely devoted to ventilative cooling. We hope to see you there. For more frequent updates, please visit our website, follow us on Twitter and LinkedIn and subscribe to our monthly newsletter 'Energy Efficiency and Indoor Climate in Buildings' to find out more about our activities. We wish you a pleasant reading.

The venticool team

**IEA EBC Annex 62: Ventilative Cooling- 8th Expert Meeting, Gent, Belgium, October 24-25, 2017**

For Hevelberg, Anthony University

16 delegates from 10 countries attended the 8th expert meeting. The host was KU Leuven, Faculty of Engineering Technology, Technologie Campus Ghent, Associate Professor Hilde Brunsch. This was the final project meeting and the main focus was completing the final reports of the project. They include a Guide Book for ventilative cooling design, a Source Book for ventilative cooling technology and a Book of Case Studies with 15 well-documented examples of application of ventilative cooling solutions and their performance. These publications will be available at the beginning of 2018 from the IEA and venticool websites.

The meeting also included a discussion of recommendations for standards, legislation and compliance tool to improve the application of ventilative cooling in new and existing buildings in the future. These recommendations are based on a thorough analysis of international standards in the field and of the present legislation as well as the compliance tools used in 8 European countries. The full background report as well as a short Summary with recommendations will also be available in the beginning of 2018.

**In this issue**

- Forecast
- 18-19 September 2018 - 39th AIVC & 7th TightVent conference in Juan-les-Pins, France
- Feedback from Brussels workshop on ventilative cooling, 21 October 2017
- Ventilative cooling summary from AIVC 2017 conference
- Home construction projects on ventilative cooling and natural and hybrid ventilation systems
- 18-19 September 2018 - 39th AIVC 'TightVent & 5th Ventilation' joint conference in Juan-les-Pins, France

# Agenda for this webinar

- **Ductwork Airtightness: Why Should We Care?**
  - Valérie Leprince, PLEIAQ, France
- **Status of Ductwork Airtightness in [Japan](#) and on-Going Work at ISO on Ductwork Airtightness**
  - Masaki Tajima, KUT, Japan
- **European Ductwork Airtightness Classes, on-Going Standardization Work and Status in [Sweden](#)**
  - Lars-Åke Mattsson, CEN/TC 156/WG3, Sweden
- **Market Trends in [Spain](#) and [Portugal](#). An Industry Point of View**
  - Rodrigo Sanz, Gonal Driving Air, Spain

# Why should we care about ductwork airtightness ?

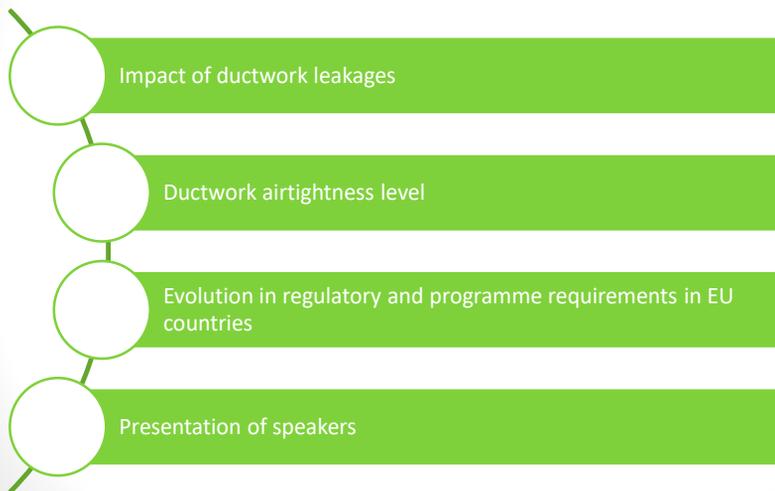
Webinar on ductwork airtightness

January 25th, 2018

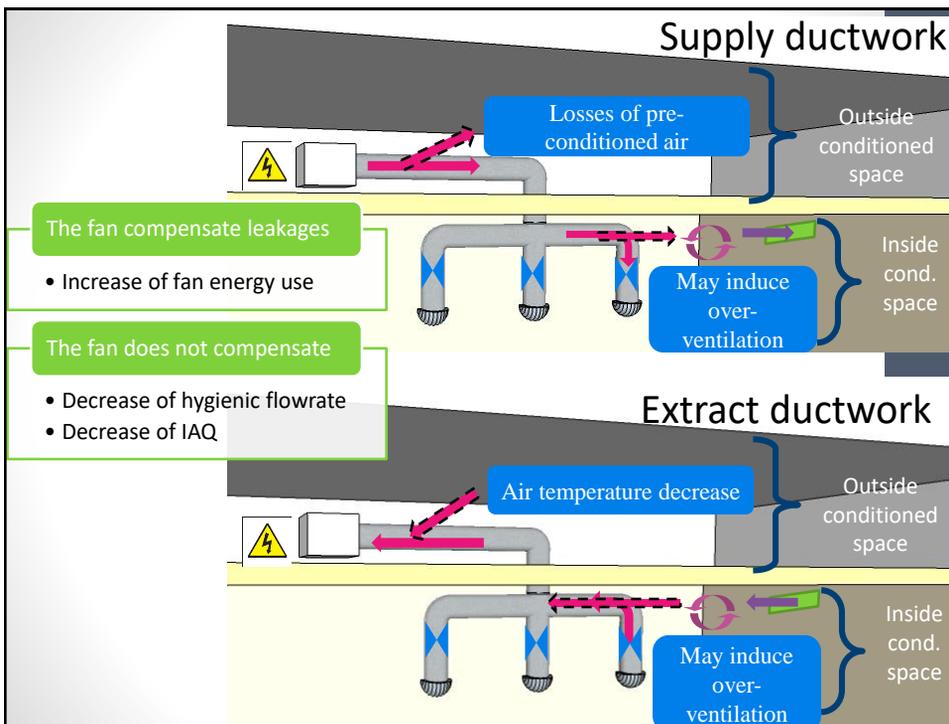
Valérie Leprince, PLEIAQ



## Outline



# IMPACT OF DUCTWORK LEAKAGES



# Fan energy use, test on laboratory replication of real ductwork system

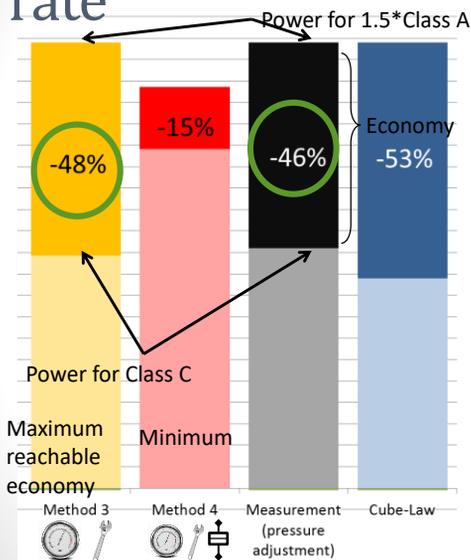


- Area 18.7 m<sup>2</sup>
- Extract fan constant pressure
- 8 self-adjusting air terminal devices
- Airflow rate:
  - Max : 525 m<sup>3</sup>/h
  - Min : 260 m<sup>3</sup>/h
- Measurement and calculation method



Source : (Berthault, Boithias, & Leprince, 2014)

# Results for maximum airflow rate



- Decrease leakages from 1,5 class A to Class C can almost **divide Fan energy use by 2**

Source: Leprince, Carrié, AIVC 2017

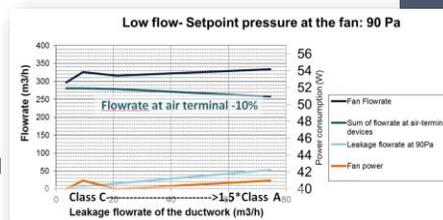
# Energy use impacts

- Impact on overall building energy use:
  - According to (Soenens, 2011) the total energy consumption related to ventilation can **be reduced by over 30%** by achieving an airtight ventilation system.
  - According to (Dyer, 2011) in a pharmaceutical plant over a 30 years life of the building the energy **penalty** associated with excessive duct leakage is **more than 1.3 million dollars**

=> More studies on the impact on heating and cooling are needed

# IAQ impacts

- Duct leakage:
  - Reduces flowrates at air terminal devices, unless fan compensates
    - A decrease of 10% of flowrate has been observed by (Berthault, 2014) if the fan is not re-adjusted
  - Suspicions:
    - Increases dust accumulation in filters, heat exchangers, ducts, ...
    - Weakens contamination protection of sensitive areas (operating theatres, clean rooms, etc.)

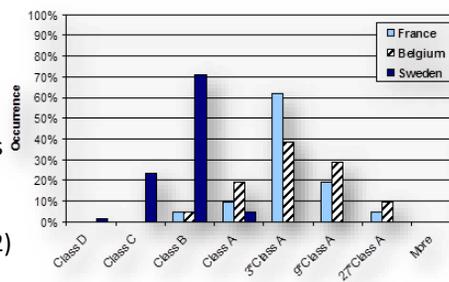


=> More studies on this field are needed

## DUCTWORK LEAKAGE LEVELS

## Ductwork leakage levels

- SAVE-DUCT project has shown striking difference between Sweden, Belgium and France (Carrié, 1999)
  - In **Sweden**, since 1966, the AMA tightness requirements have been raised to reach **Class C** for every ductwork since 2007 (Andersson, 2012)
- In US: duct leakage in 11 large buildings shown to represent on average **28% of the fan flow** (Modera, 2013)



## EVOLUTION IN REGULATORY OR PROGRAMME REQUIREMENTS

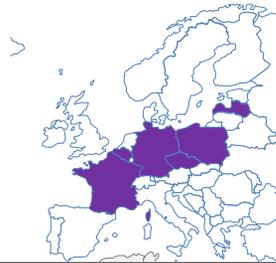
## Evolution in regulatory or programme requirements

- In **Sweden** ductwork airtightness is required
  - Since 1966
  - Since 2007: **Class C** required
- In **Portugal** for large building
  - Since 2006 ductwork leakage below **1.5 l/s.m<sup>2</sup> under 400 Pa**
- In **Belgium**
  - Taken into account in calculation method, but no minimum requirement
- In **UK**
  - **Test mandatory** for system with design flows **> 1 m<sup>3</sup>/s**
  - For low pressure ducting no test required but taken into account in calculation
  - Test typically performed by ducting contractor
- In **France**
  - Since 2013
  - Effenergie + label requires **Class A**
  - Test has to be performed by a **qualified independent technician**



## How ductwork airtightness is taken into account in regulations?

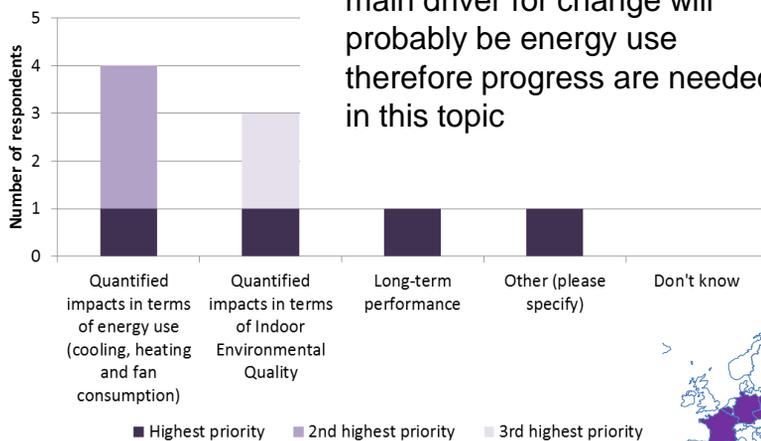
- Result of a Tightvent Airtightness Association Committee (TAAC) survey
  - Only France (RT2012) and Belgium (EPB) consider ductwork airtightness as an input in EP-regulation
    - But there is no minimum requirement
    - In France if a value better than default value is used then it has to be justified (testing or certified quality approach)
  - Awareness is low



Source Leprince, Carrié, Kapsalaki, AIVC 2017

## What is in your view the progress needed to promote ductwork airtightness in your country?

- As for building airtightness the main driver for change will probably be energy use therefore progress are needed in this topic



## PRESENTATION OF SPEAKERS

### Ductwork airtightness: standardisation's ongoing work and an overview of status and trends in Sweden, Japan, Spain and Portugal



**Lars-Ake Mattsson**

- CEN TC 156/WG3, Sweden
- European ductwork airtightness class, on-going standardization work and status in Sweden



**Masaki Tajima**

- KUT, Japan
- Status of ductwork airtightness in Japan and on-going work at ISO on ductwork airtightness



**Rodrigo Sanz**

- Gonal Driving Air, Spain
- Market trends in Spain and Portugal, an industry point of view



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# EUROPEAN DUCTWORK AIRTIGHTNESS CLASSES.

ON-GOING STANDARDIZATION WORK AND STATUS IN SWEDEN

**Lars-Åke Mattsson:**  
Convener TC156 WG3 "Ducts"  
R&D manager Lindab  
Tightvent Europe webinar, 25 January 2018



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## The big perspective



# Goals

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European Commission

## CLIMATE ACTION

European Commission > Climate Action > EU Action > Climate strategies & targets > 2020 climate & energy package

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13/11/2017 COP23: Cities and local governments for climate action  
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**2020 climate & energy package**

Policy Documentation Studies FAQ Links

**The 2020 package is a set of binding legislation to ensure the EU meets its climate and energy targets for the year 2020.**

The package sets three key targets:

- 20% cut in **greenhouse gas emissions** (from 1990 levels)
- 20% of EU energy from **renewables**
- 20% improvement in **energy efficiency**

The targets were set by EU leaders in 2007 and enacted in legislation in 2009. They are also headline targets of the **Europe 2020 strategy** for smart, sustainable and inclusive growth.

The EU is taking action in several areas to meet the targets.



# Research findings

**Tight Vent Europe**  
BUILDING AND DUCTWORK AIRTIGHTNESS PLATFORM

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- AIVC Workshop on airtightness & ventilation, 19-20 March 2018, Wellington, NZ

**Before 2020 :**  
EU countries will have to generalise nearly zero-energy buildings in new constructions and major renovations

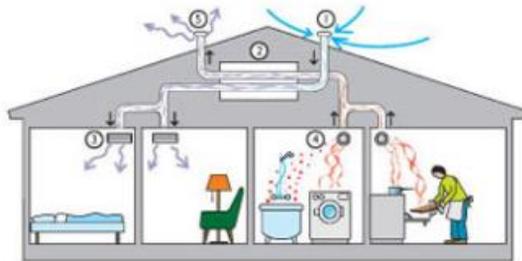
1 Build Tight Ventilate Right

2 Building and ductwork airtightness will implicitly become a mandatory concern

3 Energy efficient ventilation systems will have to be used



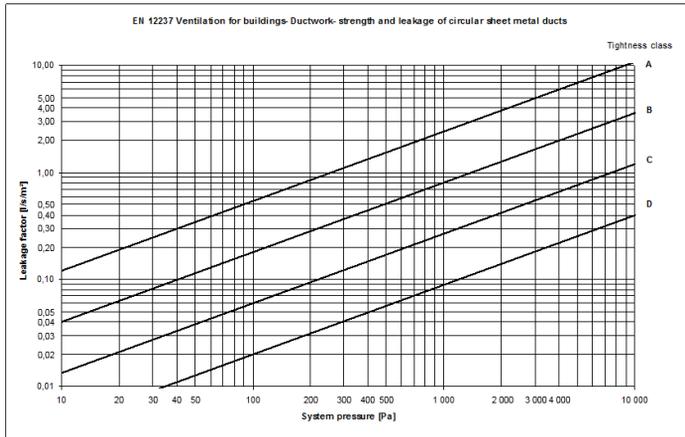
# Mechanical supply and exhausted ventilation with heat recovery



# Airtightness in ventilation ducts what is it?



# Airtightness diagram



Tightness class diagram



# EN 14239 Surface area

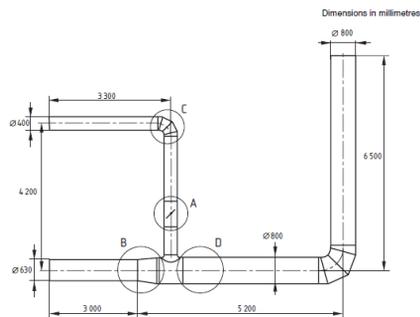


Figure 2 - Example of typical installation of ductwork with circular cross section

Table 1 - Example of calculation of duct surface area for circular ducts

Diameter mm	Duct surface area * per unit length m <sup>2</sup> /m	Length m	Total duct surface area m <sup>2</sup>
800	2,51	6,5 + 5,2	2,51 × 11,7 = 29,4
630	1,98	3,0	1,98 × 3,0 = 5,9
400	1,26	4,2 + 3,3	1,26 × 7,5 = 9,5
Total for installation shown in Figure 2			44,8

\* From Table A.1



# System test



# History



# History

1960

- \* Wallin, O.: „Täthetsförändringar hos ventilationskanaler” Tekniska meddelanden 139 från Institutionen för Uppvärmings-  
Ventilationsteknik, KTZ Stockholm.
- Pettersson, F.: „Behövs en ändrad täthetsnorm för ventilationssystem” Tekniska meddelanden 164 från Institutionen för  
Uppvärmings- och Ventilationsteknik, KTH Stockholm.



# SIS 827209

1972  
1975

Ventilationskanaler av stålplåt  
Hållfasthet och täthet

SVENSK STANDARD SIS 82 72 09  
Utgåva 1  
Sida 2

2.3 Läckflöde

Läckflödet (luftläckningen)  $q$  får vid av fabrikanten angiven täthetsklass A eller B – inte överstiga i tabell 2 angivna värden i l/s och m<sup>2</sup> mantelyta hos kanalen vid ett provtryck (övertryck) av 1 kPa. *100 mm v p*

Tabell 2

Täthetsklass	A	B
Högsta tillåtna läckflöde $q$ i l/s och m <sup>2</sup> vid 1 kPa	2,4	0,8

Angivna värden på läckflödet  $q$  överensstämmer med motsvarande värden i VVS-AMA 72.



# Eurovent 2/2

2.2 For normal ventilating and airconditioning installations, three classes of air tightness, A, B, and C have been chosen for which the upper limits of  $f \cdot P_{sm}^{-0.65}$  are represented by:

1981

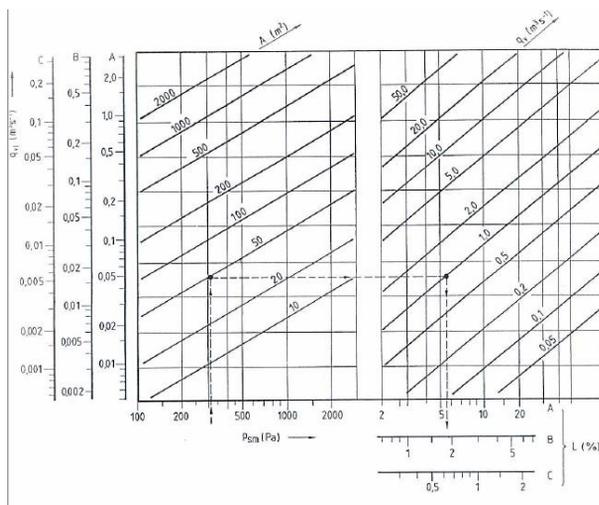
$$K_A = 0,027 \cdot 10^{-3} \text{ms}^{-1} \cdot \text{Pa}^{-0,65}$$

$$K_B = 0,009 \cdot 10^{-3} \text{ms}^{-1} \cdot \text{Pa}^{-0,65}$$

$$K_C = 0,003 \cdot 10^{-3} \text{ms}^{-1} \cdot \text{Pa}^{-0,65}$$

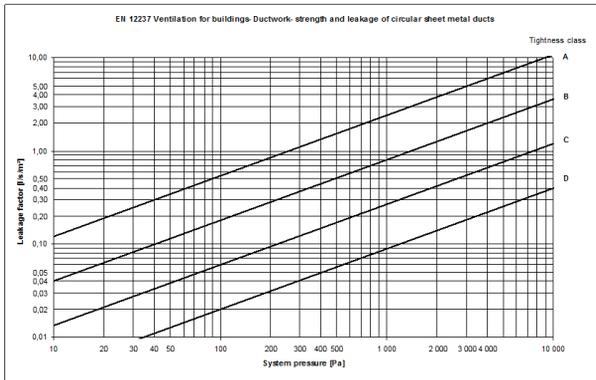


# Eurovent 2/2





# EN standards



Tightness class diagram

2003



# Third party certification

Swedish Type approval



Eurovent Certification





# Requirements from other standards



# EN 13779 Performance requirements (Old EPBD)

## A.8.2 Selection of airtightness class

The minimum airtightness class is selected according to the following principles. However, a more strict class is applied in cases where the total area of the casing is exceptionally large in relation to the total airflow, where the pressure difference across the casing is exceptionally high, or when exceptional problems result from leakage because of the demands on air quality, risk of condensation or any other reason. EN 15242 gives methods to estimate the energy impact of air leakages and further advise on selection of airtightness classes for ductwork and air handling units.

The air leakage of enclosed air-handling units, and equipment rooms and chambers for fans and other assemblies should not exceed the leakage according to class A (corresponds class L3 for air handling units, EN 1886) in Figure A.3.

Class B is the general minimum requirement for air ducts, and also the minimum for all exhaust air ducts subject to overpressure inside the building, excluding plant rooms.

Class C is the recommended minimum class in many cases, especially if the pressure difference across the duct casing is high, or if any leakage can result in a hazard to the indoor air quality, control of pressure conditions or functioning of the system.

Class D is applied in special situations, and also applicable for cases described above for Class C, especially in installations with high hygiene requirements or with special attention to energy performance.



# EN 16798-3 Performance requirements (New EPBD)

## 6.9.4 Leakages at air ducts

The classification and testing of airtightness of round ducts are defined in EN 12237, of rectangular ducts in EN 1507.

To reduce energy losses and to guarantee the planned air distribution, this value shall be minimum class B. **Class C is recommended.**



# EN 15780 Cleanliness

## F.3 Application of cleanliness levels - airtightness

The airtightness of the ductwork is also important for cleanliness. Leakages in unclean hollow spaces or suspended ceilings can have a big influence to the indoor air quality, especially for the advanced level. The minimum recommended tightness class related to these cleanliness levels can be expressed as follows, corresponding with the technical recommendations of EN 13779:2007, A.8.2,

Table F.3 — Recommended minimum tightness class

Level	Recommended minimum tightness class
Basic	B
Intermediate	C
Advanced	D

Table A.1 — Typical applications of cleanliness quality classes

Quality Class	Typical examples
Low	rooms with only intermittent occupancy e.g. storage rooms, technical rooms
Medium	offices, hotels, restaurants, schools, theatres, residential homes, shopping areas, exhibition buildings, sport buildings, general areas in hospitals and general working areas in industries
High	Laboratories, treatment areas in hospitals high quality offices



# EN 12599 Handing over

Table 1 — Summary of tests, measurements and report to verify the quality of the systems

Required Steps	Purpose	Activities	Annexes
Step a Completeness checks	To ensure that the ventilating and air conditioning system has been installed entirely in accordance with contract	1. Comparison of equipment with the installation list 2. Compliance with technical rules (contract and official) 3. Accessibility 4. Cleanliness 5. Balancing 6. Air tightness 7. Documents necessary for operating	Annex A With more specified information on the activities 1 to 7

— air tightness of ducts according to EN 13779,



# EN 12599 Handing over

Table 2 — Functional measurements

Measurement at	Parameters	Total System	Central System/Appliance				Duct work				Room			
			Additional cleanliness test	Current drawn and power by the motor [D.6]	air flow *) [D.1]	air temperature *) [D.3]	pressure drop across filter [D.7]	ductwork leakage test [D.8]	supply air flow [D.1]	exhaust air flow [D.1]	supply air temperature **) and air temperature in the room [D.3]	air humidity [D.4]	sound pressure level [D.5]	Indoor air velocity [D.2]
Ventilation System	(F) Z	2	1	1	0	1	2	1	2	0	0	0	0	
	(F) H	2	1	1	1	1	2	1	2	2	0	0	2	
	(F) C	2	1	1	1	1	2	1	2	2	2	0	2	
	(F) MD	2	1	1	1	1	2	1	2	2	1	0	2	
Partial air conditioning system	(F) HC	2	1	1	1	1	2	1	2	1	2	0	2	
	(F) HMMH/CM/CD	2	1	1	1	1	2	1	2	1	1	2	2	
	(F) MD	2	1	1	1	1	2	1	2	2	1	2	2	
Air conditioning system	(F) HCM/CM/CD/IMD	2	1	1	1	1	2	1	2	1	1	1	2	
	(F) HCM/CM/CD	2	1	1	1	1	2	1	2	1	1	1	2	

\*) Outdoor air, supply and exhaust air  
 \*\*) Depending on control principles, if relevant

Explanations
0 measurement not necessary
1 to carry out in all cases
2 to carry out only in the case of contracted agreement



## **Different standards**



## **Airtightness Standards to the environment**

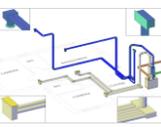


# Airtightness Standards Systems

lindab | we simplify construction

Dimensions

Strength and leakage

	EN 1506	EN12237
	EN 1505	EN 1507
	prEN 17192	prEN 17192



## Differences L/A ratio

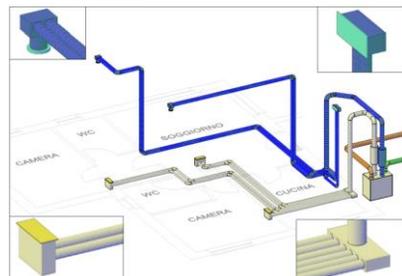
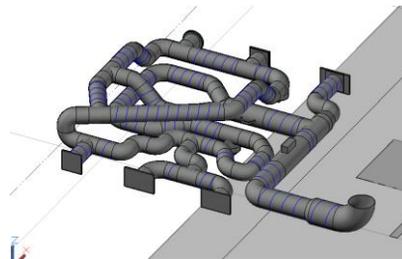
lindab | we simplify construction

For rigid ductwork, L/As shall be:

$$1m^{-1} < \frac{L}{A_s} < 1,5m^{-1}$$

For semi-rigid ductwork, L/A shall be:

$$0,4m^{-1} < \frac{L}{A_s} < 0,6m^{-1}$$





# Airtightness Standards Components

Dampers	EN 1751
Technical Components	EN 15727
Flexible ducts	EN 13180



# Differences Area calculation

## 7.2 Calculation of the total joint length (L)

The total joint length, in metres, for a product of circular cross-section is the sum of the joint perimeter of each connection (1 to n).

$$L = \pi \times (d_1 + d_2 + \dots + d_n) \tag{1}$$

The total joint length, in metres, for a product of rectangular cross-section is the sum of each joint perimeter.

$$L = 2 \times (a_1 + b_1 + a_2 + b_2 + \dots + a_n + b_n) \tag{2}$$

Technical Components

## 7.3 Calculation of the virtual product surface area (A<sub>v</sub>)

The virtual product surface area A<sub>v</sub>, in square metres, is:

$$A_v = L \times 0.5 \tag{3}$$

or

$$A_v = A_p \text{ (the product surface area)} \tag{4}$$

whichever is the larger.

## C.3 Casing leakage

The range of case leakage performance has been related to the general ductwork leakage classes as follows:

The reference casing area is taken as the **perimeter of the damper multiplied by an equivalent length of 1 m.**

Dampers

Figure C.2 gives for classes A, B and C the permitted maximum case leakage  $q_{d,CA}$  in  $1 \text{ s}^{-1} \text{ m}^2$  as a function of duct static pressure  $p_s$ , in Pa.

The leakage factor shall be determined by the air leakage rate divided by the surface area  $\pi \cdot d_n \cdot L$  where L is the length of the reference test element and  $d_n$  is its nominal diameter.

Flexible ducts



## Differences

### Area calculation “1 meter duct”

### Same theory in both EN 1751 and EN 15727

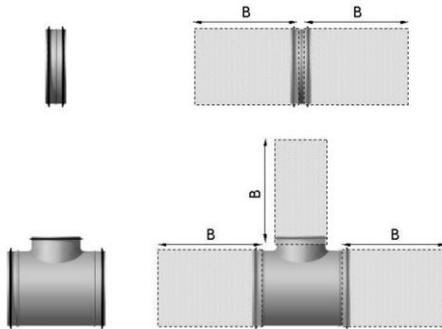


Figure 1. Virtual duct lengths B applied to circular slip-in joint and T-piece.



## Airtightness Standards Air Handling Units

Air Handling Units	EN 1886
--------------------	---------

Table 4 — Casing air leakage classes of air handling units, 400 Pa negative test pressure

Leakage class of casing	Maximum leakage rate ( $f_{400}$ ) $l \times s^{-1} \times m^{-2}$	Filter class (EN 779)
L3	1,32	G1 to F7
L2	0,44	F8 to F9
L1	0,15	superior to F9



## Airtightness Standards in field at the handing over process

Handing over	EN 12599
--------------	----------



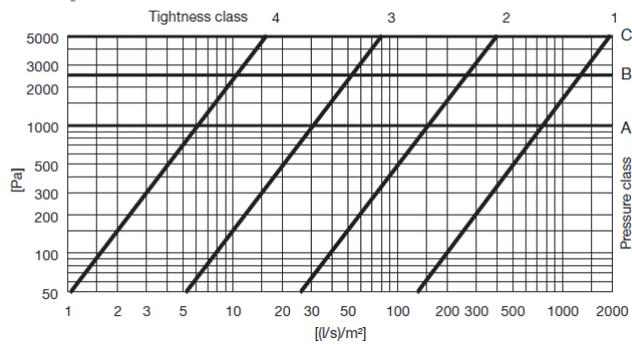
## Airtightness through damper blade Standards



# Airtightness Standards Through damper blade

Damper blades	EN 1751
---------------	---------

## Tightness past the closed damper blade and pressure classes



# Pressure classification



## Circular metallic duct classification

Table 2 – Ductwork Classification

Air tightness class	Static pressure limit ( $p_s$ ) Pa		Air leakage limit ( $f_{max}$ ) $m^3 \cdot s^{-1} \cdot m^{-2}$
	Positive	Negative	
A	500	500	$0,027 \cdot p_t^{0,65} \cdot 10^{-3}$
B	1 000	750	$0,009 \cdot p_t^{0,65} \cdot 10^{-3}$
C	2 000	750	$0,003 \cdot p_t^{0,65} \cdot 10^{-3}$
D <sup>a</sup>	2 000	750	$0,001 \cdot p_t^{0,65} \cdot 10^{-3}$

<sup>a</sup> Ductwork for special applications.



## Rectangular metallic duct classification

Table 1 — Ductwork classification

Air tightness class	Air leakage limit ( $f_{max}$ ) $m^3 \cdot s^{-1} \cdot m^{-2}$	Static gauge pressure limits (ps) Pa			
		Negative at all pressure classes	Positive at pressure class		
			1	2	3
A	$0,027 \times p_{test}^{0,65} \times 10^{-3}$	200	400		
B	$0,009 \times p_{test}^{0,65} \times 10^{-3}$	500	400	1 000	2 000
C	$0,003 \times p_{test}^{0,65} \times 10^{-3}$	750	400	1 000	2 000
D <sup>a</sup>	$0,001 \times p_{test}^{0,65} \times 10^{-3}$	750	400	1 000	2 000

<sup>a</sup> Ductwork for special application.



## In field classification

### D.8 Air leakage

#### D.8.1 Measuring method

The leakage measurements can be performed while the duct system is being installed.

As soon as a sufficiently large section of the air duct system has been installed, all openings are sealed off. A fan which is connected to the sealed duct system through an equipment for measuring is used to generate a test pressure difference above or below atmospheric pressure. The test pressure should be adjusted to one of the following values which should be chosen to be as **near** as possible to mean **operating pressure** of the system, preferably:

200 Pa, 400 Pa, or 1 000 Pa above atmospheric in case of supply air ducts or 200 Pa, 400 Pa or 750 Pa below atmospheric in case of exhaust air ducts.

If measurement equipment is used to verify tightness class A or B, it is possible that the above named pressure values could not be achieved at a greater ductwork surface area.

In this cases, the tightness class could be determine by a lower pressure, using the following formula to calculate the leakage airflow approximately:



## New standards



## New non metallic ducts

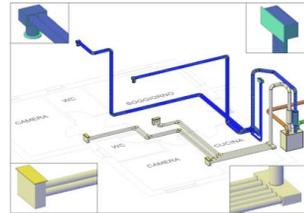
To small system

New shapes on ducts

New shapes on manifolds

Other criteria for pressure

L/A 1-1,5



## solutions

To small system

at least 10 m2 or whole system

New shapes on ducts

measure the exact area

New shapes on manifolds

ad the whole surface of the cube or outline

Other criteria for pressure

Same idea as EN12599

L/A 0,4-0,6

Recommendation for supplier



# US standards



## Comparison European US classes

Generally, the air tightness classes are applied by European Union (EU) member countries as listed in Table 12-4. For the United States, ASHRAE originally developed "Air Leakage Class ( $C_L$ )" to predict air leakage from round, rectangular, flexible, and fibrous glass duct using data from research conducted in 1985 (RP-308). Today, ASHRAE is using air leakage classes in the same manner as European countries. Figure 12-5 shows the relationship of European air tightness classes and leakage classes. The equivalency between EU and ASHRAE leakage classes is noted on these figures; namely, A ( $C_L=19$ ), B ( $C_L=6.4$ ), C ( $C_L=2.1$ ), and D ( $C_L=0.7$ ).

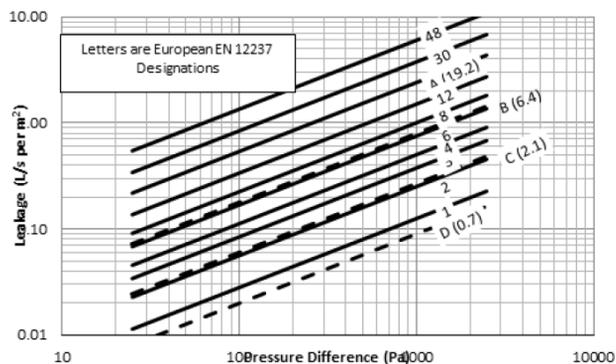


Figure 12-5. Relationship between European air tightness classes (dash lines) and ASHRAE leakage classes (solid lines) (SI units).



## Source comparison

International Energy Agency

### Deep Energy Retrofit

A Guide to Achieving Significant Energy Use Reduction with Major Renovation Projects

Annex 61, Subtask A



## Sweden news



# Study



## Tätning av ventilationskanaler

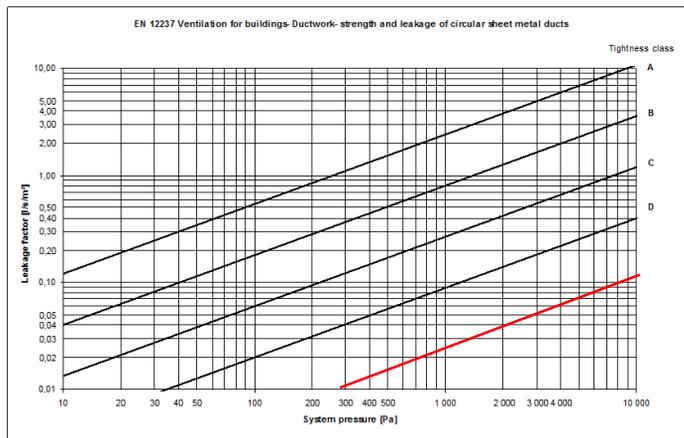
Förstudie inför teknikupphandling

Upprättad av  
Katarina Högdal, WSP Environmental  
2014-12-12

<http://www.bebostad.se/library/1867/foerstudie-kanaltaetning.pdf>



# Class E



Tightness class diagram



## Class E

My view:

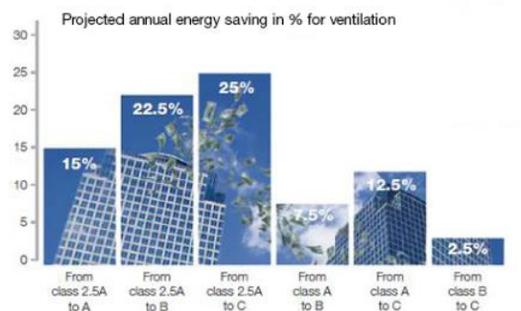
1. No demand from energy perspective.
2. Wet cleaning demand.
3. Problem with grease drips from factory processing.
4. Smell from garbage ventilation with over pressure.

2-3 should be solved by airtight or downpipe principle  
4 should be solved by airtight or negative pressure.



## Lindab duct leaking calculator

<https://www.lindqst.com/ads/calcleak/default.aspx>





# Thank you!

## Good Thinking



At Lindab, good thinking is a philosophy that guides us in everything we do. We have made it our mission to create a healthy indoor climate – and to simplify the construction of sustainable buildings. We do this by designing innovative products and solutions that are easy to use, as well as offering efficient availability and logistics. We are also working on ways to reduce our impact on our environment and climate. We do this by developing methods to produce our solutions using a minimum of energy and natural resources, and by reducing negative effects on the environment. We use steel in our products. It's one of few materials that can be recycled an infinite number of times without losing any of its properties. This means less carbon emissions in nature and less energy wasted.

**We simplify construction**





## Status of Ductwork Airtightness in Japan and On-going Work at ISO on Ductwork Airtightness



Kochi University of Technology

Assoc. Prof. **Masaki TAJIMA**, PhD  
tajima.masaki@kochi-tech.ac.jp

## Contents

- I. Status of Ductwork Airtightness in Japan
  - 1. Building Standard Law
  - 2. Building Energy Efficiency Act
  - 3. Discussion
  
- II. On-going Works
  - 1. Works at ISO/TC163/SC1/WG10
  - 2. Ductwork Airtightness



# Contents

## I. Status of Ductwork Airtightness in Japan

1. Building Standard Law
2. Building Energy Efficiency Act
3. Discussion

## II. On-going Works

1. Works at ISO/TC163/SC1/WG10
2. Ductwork Airtightness



3

## Status of Ductwork Airtightness in Japan Building Standard Law

- The Building Standard Law
  - is the **mandatory** and primary law concerning building codes
  - requires minimum standards concerning the site, construction, **equipment** and use of buildings

Reference: Introduction to the Building Standard Law, [www.bcj.or.jp](http://www.bcj.or.jp)

- About airtightness related in ductworks
  - In an Order for Enforcement of the Standard, airtightness of **Fire dampers** is required

**No requirement on  
airtightness of  
ductworks**

4

## Status of Ductwork Airtightness in Japan Building Energy Efficiency Act

- Standards of the Act
  - Calculation of envelope performance and primary energy consumption amount targeting for newly built buildings is required
  - The calculation is executed in design term
  - It becomes full obligation in 2020

Reference: [www.mlit.go.jp/common/001134876.pdf](http://www.mlit.go.jp/common/001134876.pdf)

- About airtightness related in ductworks

5

## Status of Ductwork Airtightness in Japan Official Program for Calculating Primary Energy (Building Energy Efficiency Act)

Program for calculating primary energy consumption in house Ver 2.3.1

Load Save Designed 84288 MJ/year Calc Output

Commons Envelope Heating Cooling Ventilation **HEX** DHW Solar Lighting PV Cogeneration

Type of Ventilation

Select type of ventilation

Balanced ventilation system with duct

Supply only or exhaust only ventilation system with duct

Wall-mounted balanced ventilation unit

Wall-mounted supply only or exhaust only ventilation unit

When ventilation system with duct is installed

Whether energy saving technique(s) is/are adopted or not, and its/these type(s)

Any energy saving technique is not adopted

Select the energy saving technique(s)

Evaluate energy saving effect by inputting the specific fan power

Specific fan power

0.30 W/(m<sup>3</sup>/h)

(the second decimal place)

Air change

Air change

0.5air change per hour

0.7air change per hour

0.0air change per hour

Reference: [house.app.lowenergy.jp](http://house.app.lowenergy.jp)

6

## Status of Ductwork Airtightness in Japan Building Energy Efficiency Act

- Standards of the Act
  - Calculation of envelope performance and primary energy consumption amount targeting for newly built buildings is required
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  - It becomes full obligation in 2020

Reference: [www.mlit.go.jp/common/001134876.pdf](http://www.mlit.go.jp/common/001134876.pdf)

- About airtightness related in ductworks

No requirement  
even on  
airtightness of  
building

No requirement on  
airtightness of  
ductworks

7

## Status of Ductwork Airtightness in Japan Discussion : What makes the present situation

### Design term

- **Building Standard Law & Building Energy Efficiency Act**
- by MLIT (Ministry of Land Infrastructure, Transport and Tourism)

### Operation term

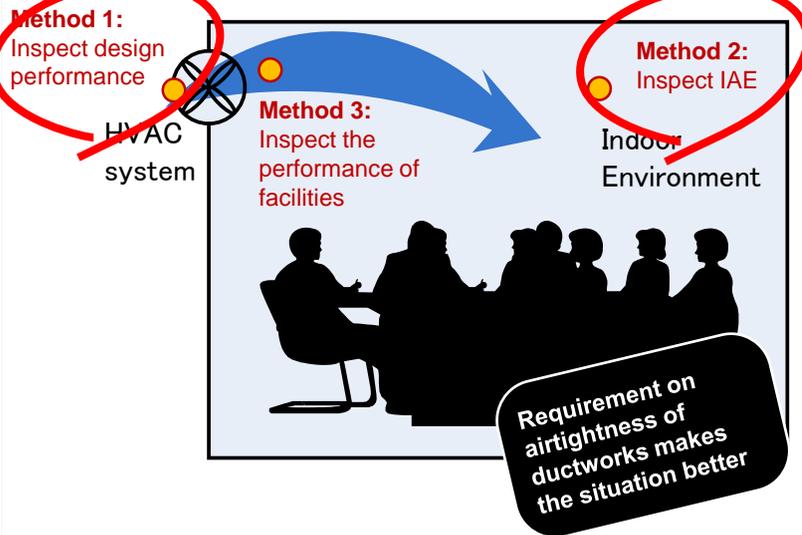
- **Act on Maintenance of Sanitation in Buildings**
- by MHLW (Ministry of Health Labour and Welfare)
  - Measurement of indoor air environment has to be executed every 2 months or more
  - Floor area of target building is greater or equal to 3,000m<sup>2</sup>



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## Status of Ductwork Airtightness in Japan Discussion : Summary

- How to achieve energy conservation & good IEA



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## Contents

- I. Status of Ductwork Airtightness in Japan
  1. Building Standard Law
  2. Building Energy Efficiency Act
  3. Discussion
- II. On-going Works
  1. Works at ISO/TC163/SC1/WG10
  2. Ductwork Airtightness



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## On-going Works Works at ISO/TC163/SC1/WG10

1. Measurement of airtightness of building
  - 1) High-rise building > under discussion
  - 2) Large building > the proposal from USA
2. Air tightness of building elements and assemblies
  - 1) Ducts > under discussion
  - 2) Barrier assemblies > ISO14857-2014
  - 3) Partition, etc.
3. Evaluation of the measurement of airtightness
  - 1) Uncertainties > under discussion
4. Measurement of ventilation rate
  - 1) Multizone ventilation

**TC163:** Thermal performance and energy use in the built environment  
**SC1:** Test and measurement methods  
**WG10:** Air tightness of buildings

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## On-going Works Ductwork Airtightness

### Ductworks

- 1) Status
  - a) ASTM, CEN and northern European countries have related regulations with the brief description on measurement procedures
- 2) Importance
  - a) To indicate the leak position of the ventilation system
  - b) To improve the airtightness of the building
- 3) Tasks to be settled
  - a) Overlooking the status in terms of the codes and the regulations
  - b) Practical measuring system, procedures, etc. should be shown

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## On-going Works Ductwork Airtightness

### Accumulating Knowledge

#### Products

- Duct, components and so on
- Measurement instruments

#### Standards

- ASTM E1554
- EN 1509
- EN 12237
- EN14239
- EN 15727
- and so on

#### Lectures

～建築環境・省エネルギー機関 講演会～  
「欧州のエネルギー施策が建物及び空調ダクトの気密性に及ぼす影響」  
Impact of Energy Policies on Building and Ductwork Airtightness in Europe

この度、ヨーロッパの建築気密性能に関する国際的組織 (INVE International Network for Information on Ventilation and Energy Performance) のシニア・コординエーターを務める Rasmus Clausen 博士が ISO TC163 の会合のため来日されるのを機に、機会の多いものとして、講演会を開催いたします。講演会には下記の内容が中心として詳細に解説いたします(要領書参照)。

講演会では下記の内容が中心として詳細に解説いたします(要領書参照)。

1) 居住住宅及び商業建物の空調ダクトの気密性能の計測と評価  
2) 建物のエネルギー性能評価における気密性能の重要性  
3) 2016年度に完了した欧州の調査研究プロジェクト  
4) (AIA) による「省エネルギー性能の継続的向上のための、気密性能・空調性能分野の継続的研究」に関する講演。

<http://www.duck-station.com> による取組の紹介

講演者: Rasmus Clausen (博士)

主催: 一般財団法人建築環境・省エネルギー機構  
日 時: 平成 29 年 9 月 27 日 (水) 9:30-12:00  
会 場: 一般財団法人建築環境・省エネルギー機構 (第 1 大会議室)  
(東京都千代田区麹町 3-6-1 5 階 501 号室)  
定 員: 50 名 (事前の申し込みが必要です。)  
参加費: 無料 (定員に達しない限り、受付終了となります。)  
要 領 書: 無料 (学費による要領書あり。)

プログラム: [www.duck-station.com](http://www.duck-station.com) の「Ductwork Airtightness」を参照してください。

1. 挨拶  
2. 講演: Impact of Energy Policies on Building and Ductwork Airtightness in Europe  
INVE, Sensor Consultant, Rasmus Clausen, Ph.D.  
3. 参加者とのディスカッション

INVE (Duct) 及びウェブサイト  
教授、IOE SAPL 代表、INVE (International Network for Information on Ventilation and Energy Performance) シニア・コординエーター、フランス国立応用科学大学院にて博士号、ヨーロッパ建築気密性能に関する博士号取得者、ENVEE, Caracal, 社を経て、ISO TC163 のメンバー。また、ANC (Air Infiltration and Ventilation Centre) の主要メンバーとして、気密性能、換気及び建築の発展。

# MARKET TRENDS IN SPAIN & PORTUGAL

## AN INDUSTRY POINT OF VIEW

Webinar of Ductwork airtightness, 25/01/2018  
Rodrigo Sanz

### Introduction

➤ Since 1986 in Barcelona

➤ Our group



➤ Plastic Ductwork

➤ Ventilation Systems

➤ Metallic Ductwork

➤ Members of



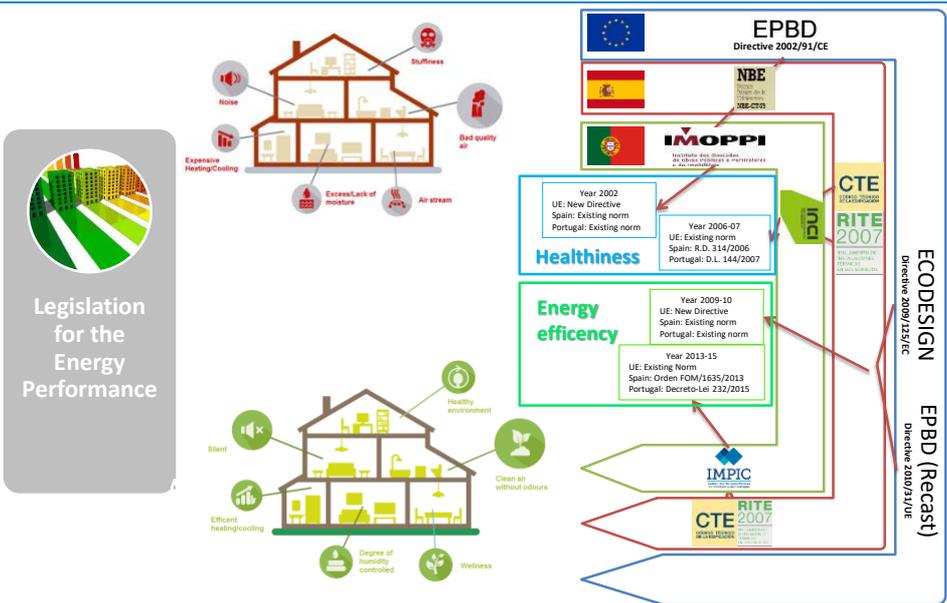
➤ Integration in Technical Comitee in



# Need to align the concepts!



# Legislation





Indoor Air Quality (IAQ)

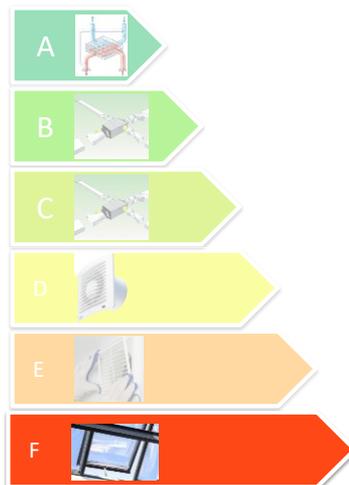
### Healthy homes in air tight buildings



CO <sub>2</sub> [ppm]	Air Quality
2100	☠️
2000	
1900	
1800	😞
1700	
1600	
1500	😐
1400	
1300	
1200	😊
1100	
1000	
900	
800	
700	
600	
500	
400	



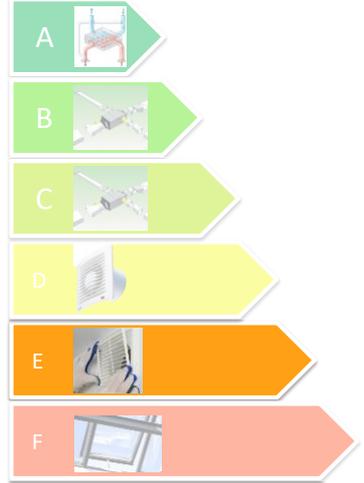
MEV & MVHR Ventilation Strategies



Windows

# Ventilation Strategies

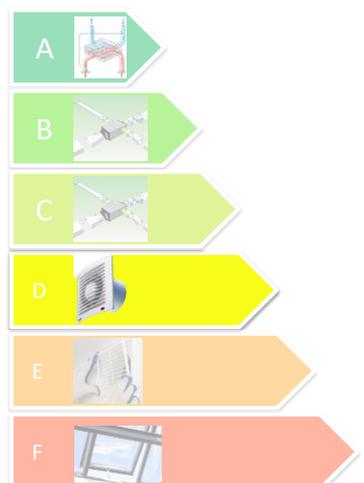
MEV & MVHR Ventilation Strategies



Grilles

# Ventilation Strategies

MEV & MVHR Ventilation Strategies



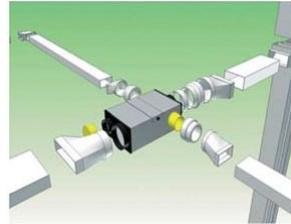
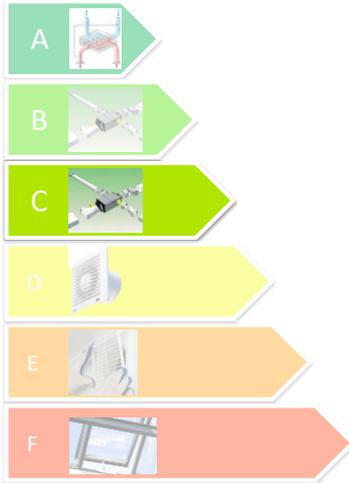
Extract Fan

## Ventilation Strategies



MEV &  
MVHR  
Ventilation  
Strategies

•



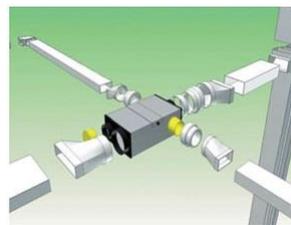
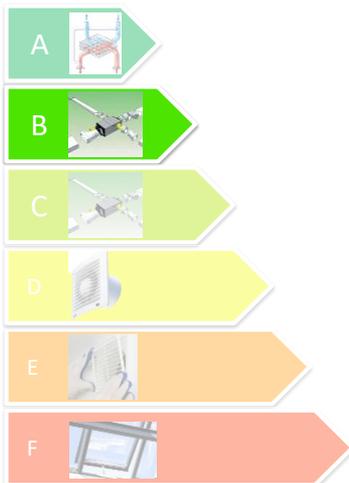
Self-Balanced Ventilation System

## Ventilation Strategies



MEV &  
MVHR  
Ventilation  
Strategies

•

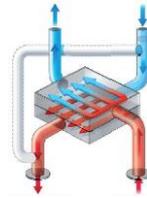
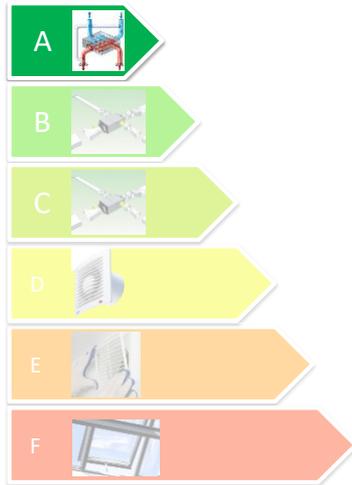


Humidity-Sensitive Ventilation System

## Ventilation Strategies

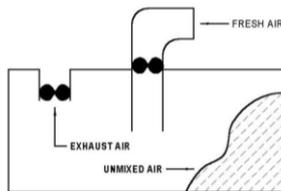


MEV &  
MVHR  
Ventilation  
Strategies



Heat-Recovery  
Ventilation System

## Systems & Products Technologies



- **Poorly designed air distribution systems**

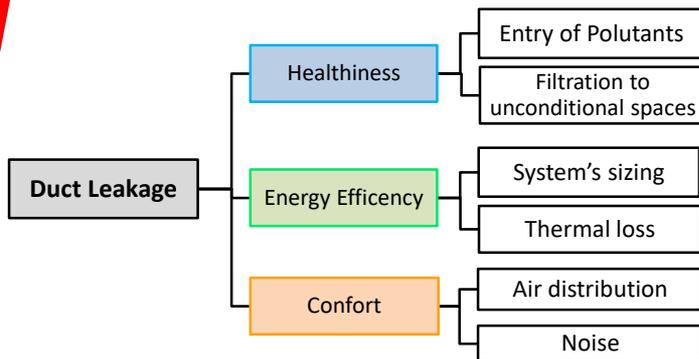




- **Poorly installed air distribution system or bad product choice**



- **Leakage consequences**

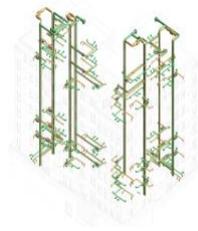




## Best practises are needed



- **BEST PRACTISE design principles to minimise pressure loss**



- **BEST PRACTISE installing principles to avoid leakage in connections**

## We offer solutions in plastic ductwork systems Tubpla® Pure StancoFix



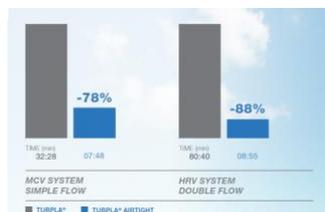
- **Integrated air-tight seals**
- **Mechanical connections**



- **Extremely Airtight Class D according to EN 12237**

- **Extremely easy and quick to install**

**Cost saving**



GONAL® contributes to energy efficiency

## Benefits for better practise of Tubpla® Pure StancoFix



- The widest range of plastic air-tight mechanical connections ductwork.



### > AIR FLOW:

	SYSTEM 150	SYSTEM 125	SYSTEM 100
<b>SIZES (mm)</b>	Ø 150 180x90	Ø 125 220x55	Ø 100 110x55
<b>FLOWS (m³/h)</b>			
maximum*	240	180	90
minimum**	150	100	50

\* Air speed = 4.0 m/s  
\*\* Air speed = 2.5 m/s



- Antibacterial and Antistatic duct!
- Preventing diseases
- Avoiding dust embedded into the duct and preserving stocked ducts



## Tubpla® Airtight Pure, integrating value in the concepts!



Legislation for the Energy Performance



Indoor Air Quality (IAQ)



MEV & MVHR Ventilation Strategies



Tubpla® ductwork technology





..., biting for a better practise

**Thank you!**